

## Multimeter/Clamp/Voltage and Continuity Testers

### Find out more about DMMs and Clamp Meters.

Handheld digital multimeters (DMM) are among the most widely used instruments for equipment testing when it comes to servicing, repairing, and installing applications.

A DMM is a digital meter that is capable of making various types of measurement. It may have any number of special features, but mainly a DMM measures volts, ohms, and amperes. DMMs are used to troubleshoot electrical problems in a wide array of industrial and household devices such as batteries, motor controls, appliances, power supplies, and wiring systems.

Metrel DMMs are appropriate for testing under tough conditions and can be tossed into tool cases.

When choosing a clamp meter not only look at specifications, but also pay attention to features, functions, and the overall value represented by a meter's design:

- Choose a clamp meter that gives accurate and repeatable results.
- For precise measurements choose a clamp meter which reports TRMS reading. Otherwise noise from everything from a variable frequency drive to compact fluorescent bulbs can result in a less accurate reading.
- Make sure that the clamp meter is specified to work in the environment you do and that are rugged enough to continue to give reliable results even in case they drop from ladders or bouncing in your tool case.
- Be sure the clamp meter display has large, easy to read characters.

### RMS (Root Mean Square) value

When an AC supply is placed onto a circuit, it produces heat. The RMS value is the equivalent DC supply that would produce the same amount of thermal heat as the actual AC supply.

### TRMS (True RMS) value

TRMS is a specific method of measuring the RMS value of a signal. With inductive and capacitive systems distorting the sinusoidal wave of the mains supply, this method provides the most accurate RMS value regardless of the shape of the waveform.

### Resolution

Resolution is the smallest possible change in a signal that would produce a change in the value on the screen of the test instrument. For example, if the DMM has a resolution of 1 mV on the 4 V range, it is possible to see a change of 1 mV (1/1000 of a volt) while reading 1 V.

### Accuracy

Accuracy is a value to show how accurately an instrument can read a specific value. This is usually written as a percentage (e.g.  $5\text{ V} \pm 5\%$ ). An accuracy of one percent of reading means that for a displayed reading of 100 volts, the actual value of the voltage could be anywhere between 99 volts and 101 volts.

### Number of Counts

The number of divisions into which a given measuring range is divided. This can be used to evaluate the resolution of an instrument.

### The basics of measurements

DC and AC voltage

One of the most basic tasks of a DMM is measuring voltage. A typical DC voltage source are the batteries while AC voltage is usually created by a generator. The wall outlets are common sources of AC voltage.

Testing for proper supply voltage is usually the first step when troubleshooting a circuit. If there is no voltage present, or if it is too high or too low, the voltage problem should be corrected before investigating further.

A DMM's ability to measure AC voltage can be limited by the frequency of the signal. Most DMMs can accurately measure AC voltages with frequencies from 50 Hz to 500 Hz, but a DMMs AC measurement bandwidth may be hundreds of kilohertz wide. Such a meter may read a higher value because it is capable to see more of a complex ac signal. DMM accuracy specifications for AC voltage and AC current should state the frequency range along with the range's accuracy.

Frequency is measured in hertz (Hz) the number of times per second a waveform repeats. Maintaining the right frequency is crucial for devices that rely on AC voltage and current.

### Crest factor

The crest factor describes the ratio of the peak value to the RMS value of an electrical variable (AC voltage and AC current). High crest factors cause distortion of the reactive power and harmonics in the supply network, and so are undesirable.

### Resistance

Resistance values can vary greatly, from a few milliohms ( $\text{m}\Omega$ ) for contact resistance to billions of ohms for insulators. Most DMMs measure from  $0.1\ \Omega$ , up to  $300\ \text{M}\Omega$ . At Metrel DMM display is infinite resistance (open circuit) read as "OL" and means that the resistance is greater than the meter can measure. Resistance measurements must be made with the circuit power off – otherwise, the meter or circuit could be damaged.

### Continuity

Continuity is a quick "go/no-go" resistance test that distinguishes between an open and a closed circuit. A DMM with a continuity beeper allows you to complete many continuity tests easily and quickly. The DMM will beep if there is good continuity, or a good path that allows current to flow. If there is no continuity, the DMM won't beep.

## Multimeter/Clamp/Voltage and Continuity Testers

### Diode test

This mode measures and displays the actual voltage drop across a junction. A silicon junction should have a voltage drop less than 0.7 V when applied in the forward direction and an open circuit when applied in the reverse direction. When the red (+) lead is connected to the anode and the black (-) to the cathode, the diode should conduct and the meter will display a value (usually the voltage across the diode in mV,  $1000\text{mV} = 1\text{V}$ ). After reversing the connections the diode should not conduct this way so the meter will display "OL".

### Capacitance

To test capacitance, set the dial on the DMM to the capacitance function and plug in your leads. After ensuring that the capacitor has been discharged, connect the test leads to the capacitor terminals and take a reading. If the measurement is similar to the rating listed on the capacitor, the capacitor is good. A significant variation from the rating indicates the capacitor should be replaced.

### DC and AC current




Current measurements are different from other DMM measurements. Current measurements taken with the DMM alone require placing the meter in series with the circuit being measured. This means opening the circuit and using the DMM test leads to complete the circuit. This way all the circuit current flows through the DMMs circuitry.







### Current with Clamp Meter

Today's clamp meters are capable of measuring both AC and DC current. Typical current measurements are taken on various branch circuits of an electrical distribution system. By taking current measurements along the run of a branch circuit, it can be easily determined how much each load along the branch circuit is drawing from the distribution system.



## Selection Guide for Multimeters

Part No.:	MD 9060	MD 9050	MD 9040
			
True RMS	✓	✓	✓
DC current range (A)	10	10	10
Basic accuracy (%)	0.15	0.2	0.2
Maximum resolution (µA)	0.1	0.1	0.1
AC current range (A)	10	10	10
Basic accuracy (%)	0.5	0.6	0.6
Maximum resolution (µA)	0.1	0.1	0.1
DC voltage range (V)	1000	1000	1000
Basic accuracy (%)	0.02	0.06	0.06
Maximum resolution (µV)	10	10	10
AC voltage range (V)	1000	1000	1000
Basic accuracy (%)	0.3	0.5	0.5
Maximum resolution (µV)	10	10	10
Resistance measurement (MΩ)	50	60	60
Basic accuracy (%)	0.07	0.1	0.1
Maximum resolution (mΩ)	100	100	100
Acoustic continuity test	✓	✓	✓
Diode test	✓	✓	✓
Capacitance	✓	✓	✓
Frequency measurement	✓	✓	✓
Frequency of digital signals	✓	✓	✓
Temperature measurement (Type K sensor)	T1 & T2 (temperature comparison)	T1 & T2 (temperature comparison)	–
Autocheck® V / Ω	–	✓	–
Conductance (nS)	✓	✓	–
IP-RPM (Inductive pickup type)	–	–	–
IG-RPM (Contact signal type)	–	–	–
Dwell – Angle function	–	–	–
% - Duty Function	–	–	–
Fuel injection – ms detector	–	–	–
100 kHz Voltage Bandwidth	✓	–	–
Variable frequency drive	✓	–	–
Count	50.000 (fast mode) 500.000 (DCV) 99.999 (Hz)	9999 (AC/DCV, Hz, nS) 6000 (mV, µm/A, Ω, F)	
Backlight	✓	✓	–
Analogue bar-graph	41 segment	41 segment	41 segment
IR, RS232 interface	✓	✓	✓
Automatic and manual range selection	✓	✓	✓
Automatic switch off	✓	✓	✓
Non-contact electrical field detection (EF)	–	✓	–
MAX hold	✓	–	–
Peak hold	✓	✓	–
Data hold	✓	✓	✓
Recording (MAX / MIN / AVG)	✓	✓	✓
Relative value	✓	✓	✓
Compensation for test leads	–	✓	✓
Overvoltage category	CAT IV / 1000 V	CAT IV / 1000 V	CAT IV / 1000 V
Dimensions with holster (mm)	208 x 103 x 64.5	208 x 103 x 64.5	208 x 103 x 64.5
Weight with holster (g)	635	635	635
CE mark	✓	✓	✓

MD 9035	MD 9030	MD 9020	MD 9016	MD 9015	MD 9010
					
–	✓	–	–	–	–
10	10	10	8	10	0.002
0.7	1.2	1.2	0.5	0.8	1.2
0.1	0.1	0.1	0.1	0.1	0.1
10	10	10	8	10	0.002
2.2	1.5	1.5	1.0	1	1.5
0.1	0.1	0.1	0.1	0.1	0.1
1000	1000	1000	1000	1000	600
0.4	0.3	0.3	0.4	0.3	0.5
10	100	100	10	100	1000
1000	1000	1000	1000	750	600
2.0	1.5	1.5	1.0	1	1.5
10	100	100	10	100	1000
60	40	40	60	25	6
0.5	0.6	0.6	0.5	0.4	1
100	100	100	100	100	100
✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓
–	–	–	✓	–	–
T1	T1	T1	T1	T1	–
–	–	–	–	–	✓
–	–	–	–	–	–
✓	–	–	–	–	–
✓	–	–	–	–	–
✓	–	–	–	–	–
✓	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
6000	4000	4000	6000	2500	6000
✓	✓	–	–	–	–
24 segment	–	–	24 segment	–	–
–	–	–	✓	✓	–
✓	✓	✓	✓	✓	Auto
✓	✓	✓	✓	✓	✓
–	–	–	✓	✓	✓
–	✓	✓	✓	–	–
–	–	–	–	–	–
✓	✓	✓	✓	✓	–
–	–	–	–	–	–
–	✓	✓	✓	✓	–
–	–	–	–	–	–
CAT II / 1000 V	CAT IV / 300 V CAT III / 600 V CAT II / 1000 V	CAT IV / 300 V CAT III / 600 V CAT II / 1000 V	CAT IV / 300 V CAT III / 600 V CAT II / 1000 V	CAT IV / 300 V CAT III / 600 V CAT II / 1000 V	CAT III / 300 V CAT II / 600 V
161 x 80 x 50	198 x 97 x 55	198 x 97 x 55	161 x 80 x 50	160 x 82 x 48	113 x 53 x 10.2
340	396	396	340	345	78
✓	✓	✓	✓	✓	✓



## MD 9060 TRMS, 500.000 counts LCD, 100 kHz Voltage Bandwidth Heavy Duty Industrial Multimeter

The MD 9060 ranks among the most accurate multimeters with a large bandwidth and very high resolution. Metrel MD 9060 is equipped with a built-in VFD feature that makes the instrument capable of measuring the true values in accordance with frequency, large 2-line 500.000 counts LCD display, fast data acquisition and transfer (via optical interface), CAT IV / 1000 V, TRMS current and voltage measurement, conductance measurement and fast one-handed operation. MD 9060 has a wide range of extra features, including data hold, memory, min / max, average, differential, peak, peak / peak with extra fast 1ms response time, auto power off, frequency filter, reset and relative function. The MD 9060 is the ideal choice for demanding measurement tasks in industry, in the laboratories and in everyday repair and maintenance practice.

### MEASURING FUNCTIONS:

- TRMS AC, DC voltage measurement;
- TRMS AC, DC current measurement;
- Capacitance measurement;
- Resistance measurement;
- Diode test;
- Mains supply frequency measurement;
- Frequency of digital signals measurement;
- Continuity test (acoustic signaling);
- Conductance measurement;
- Temperature measurement.

### KEY FEATURES:

- **TRMS:** accurate readings on sinusoidal and non-sinusoidal signals.
- **VFD:** feature makes the instrument capable of measuring the true values in accordance with frequency.
- **Auto-ranging:** user can switch between auto and manual ranging.
- **Temperature measurement:** measures T1, T2 and T1 + T2 temperature in Celsius and in Fahrenheit.
- **Lead alert:** incorrect lead connection alert.
- **Relative zero mode:** relative function for comparing the difference between signals or removing background noise.
- **MAX/MIN/AVG:** recording of maximum, minimum and average values.
- **Data Hold:** data hold feature freezes the display for later view.
- **Peak Hold:** Crest (instantaneous peak) capture mode.
- **PC Link:** test results can be downloaded to the computer via the optional PC software.
- **Safety:** CAT IV / 1000 V overvoltage protection.
- **Backlight:** large bright 4 digits 500.000 counts dual LCD display with backlight for working in dark conditions.

### APPLICATION:

- High level industrial testing;
- High level electronic fault finding;



- Field servicing;
- Heavy duty electrical testing.

### STANDARD SET:

- Multimeter MD 9060 with rubber holster
- Test lead with probe, 2 pcs
- Thermocouple probe, type K
- 9 V battery,
- Instruction manual
- Warranty



### TECHNICAL SPECIFICATION:

Function	Range	Accuracy
TRMS AC and AC+DC voltage (20 Hz ... 40kHz)	500.00 mV ... 1000.0 V	from $\pm(0.45\%$ of reading + 40 digits) to $\pm(4.0\%$ of reading + 40 digits)
DC Voltage	500.00 mV ... 1000.0 V	from $\pm(0.02\%$ of reading + 2 digits) to $\pm(0.15\%$ of reading + 2 digits)
AC Voltage (20 Hz ... 100 kHz)	500.00 mV ... 1000.0 V	from $\pm(0.3\%$ of reading + 20 digits) to $\pm(4.0\%$ of reading + 40 digits)
DC Current	500.00 $\mu$ A ... 10.000 A	from $\pm(0.15\%$ of reading + 20 digits) to $\pm(0.5\%$ of reading + 20 digits)
TRMS AC and AC+DC Current (40 Hz ... 100 kHz)	600.0 $\mu$ A ... 10.00 A	from $\pm(0.5\%$ of reading + 50 digits) to $\pm(5.0\%$ of reading + 50 digits)
Diode Test	2.0000 V Open-circuit voltage < 3.5 V DC, Test current 0.4 mA	$\pm(1.0\%$ of reading + 1 digit)
Resistance	500.00 $\Omega$ ... 50.000 M $\Omega$	from $\pm(0.07\%$ of reading + 10 digits) to $\pm(2.0\%$ of reading + 6 digits)
Conductance	99.99 nS	$\pm(2.0\%$ of reading + 10 digits)
Capacitance	50.00 nF ... 25.00 mF	from $\pm(0.8\%$ of reading + 3 digits) to $\pm(6.5\%$ of reading + 5 digits)
Temperature	-50.0 $^{\circ}$ C ... 1000.0 $^{\circ}$ C -58.0 $^{\circ}$ F ... 1832.0 $^{\circ}$ F	$\pm(0.3\%$ of reading + 1.5 $^{\circ}$ C) $\pm(0.3\%$ of reading + 3.0 $^{\circ}$ F)
Variable Frequency Drive AC	5 Hz ... 440 Hz	from $\pm(2.0\%$ of reading + 50 digits) to $\pm(6.0\%$ of reading + 80 digits)
Frequency of digital equipment	5.000 Hz ... 1.0000 MHz	$\pm(0.002\%$ of reading + 4 digits)
Mains frequency	10 Hz ... 200 kHz	$\pm(0.02\%$ of reading + 4 digits)
Power supply	9V battery (NEDA1604G, JIS006P, or IEC6F22)	
Overvoltage category	CAT IV / 1000 V	
Dimensions	208 x 103 x 64.5 mm	
Weight	635 g	

### MD 9050 TRMS Heavy Duty Industrial Digital Multimeter

The MD 9050 ranks among the best multimeters on the market. High resolution and accuracy, 2-line LCD display, fast data acquisition and transfer (via optical interface), CAT IV / 1000 V, TRMS current and voltage measurement, non-contact voltage detection, conductance measurement, auto check function and fast one-handed operation are highlights of the multimeter. The MD 9050 is the ideal choice for demanding measurement tasks in industry, in the laboratories and in everyday repair and maintenance practice.

MEASURING FUNCTIONS:

- TRMS AC, DC voltage measurement;
- TRMS AC, DC current measurement;
- Capacitance measurement;
- Resistance measurement;
- Diod test;
- Mains supply frequency measurement;
- Frequency of digital signals measurement;
- Continuity test (acoustic signalling);
- Conductance measurement;
- Electric field detection;
- Temperature measurement.

KEY FEATURES:

- **TRMS:** accurate readings on sinusoidal and non-sinusoidal signals.
- **Autocheck function:** automatic detection of AC voltage, DC voltage or resistance.
- **Auto-ranging:** user can switch between auto and manual ranging.
- **Temperature measurement:** measures T1, T2 and T1 + T2 temperature in Celsius and in Fahrenheit.
- **EF detection:** non-contact and probe-contact electric field detection.
- **Lead alert:** incorrect lead connection alert.
- **Relative zero mode:** relative function for comparing the difference between signals or removing background noise.
- **MAX/MIN/AVG:** recording of maximum, minimum and average values.
- **Data Hold:** data hold feature freezes the display for later view.
- **Peak Hold:** Crest (instantaneous peak) capture mode.
- **PC Link:** test results can be downloaded to the computer via the optional PC software.
- **Safety:** CAT IV / 1000 V overvoltage protection.
- **Backlight:** large bright 4 digits 9999 counts dual LCD display with backlight for working in dark conditions.

APPLICATION:

- High level industrial testing;
- High level electronic fault finding;
- Field servicing;
- Heavy duty electrical testing.

STANDARD SET:

- Multimeter MD 9050 with rubber holster
- Test lead with probe, 2 pcs
- Thermocouple probe, type K
- 9 V battery
- Instruction manual
- Warranty



TECHNICAL SPECIFICATION:

Function	Range	Accuracy
TRMS AC and AC+DC voltage (40 Hz ... 20 kHz)	60.00 mV ... 999.9 V	from ±(0.5 % of reading + 3 digits) to ±(3.0 % of reading + 4 digits)
Autocheck (ACV)	9.999 V ... 999.9 V	±(1.0 % of reading + 4 digits)
DC voltage	60.00 mV ... 999.9 V	from ±(0.06 % of reading + 2 digits) to ±(0.12 % of reading + 2 digits)
Autocheck (DCV)	9.999 V ... 999.9 V	± (0.5 % of reading + 3 digits)
DC current	600.0 µA ... 10.00 A	±(0.2 % of reading + 4 digits)
TRMS AC and AC+DC current (40 Hz ... 1 kHz)	600.0 µA ... 10.00 A	from ±(0.6 % of reading + 3 digits) to ±(1.0 % of reading + 4 digits)
Diode test	2.000 V	±(1.0 % of reading + 1 digit)
Open-circuit voltage	<3.5 V <sub>DC</sub> , test current 0.4 mA	
Resistance	600.0 Ω ... 60.00 MΩ	from ±(0.1 % of reading + 3 digits) to ±(1.5 % of reading + 5 digits)
Conductance	99.99 nS	±(0.8 % of reading + 10 digits)
Autocheck (resistance)	600.0 Ω ... 60.00 MΩ	from ± (0.5 % of reading + 4 digits) to ±(2 % of reading + 5 digits)
Mains frequency	15.00 Hz ... 50.00 kHz	±(0.04 % of reading + 4 digits)
Frequency of digital equipment	5.00 Hz ... 1.000 MHz	±(0.004 % of reading + 4 digits)
Capacitance	60.00 nF ... 25.00 mF	from ±(0.8 % of reading + 3 digits) to ±(6.5 % of reading + 5 digits)
Temperature	-50 °C ... +1000 °C	±(0.3 % of reading +2 °C)
Power supply	9 V battery (NEDA1604G, JIS006P, or IEC6F22)	
Overvoltage category	CAT IV / 1000 V	
Dimensions	208 x 103 x 64.5 mm	
Weight	635 g	

### MD 9040 TRMS Industrial Digital Multimeter

CAT IV / 1000 V overvoltage category and TRMS measurement of AC current and voltage are key features of the MD 9040. That's why it is particularly suitable for performing measurements on power supply sources in the most demanding applications in the industrial sector. Its high accuracy, 2-line LCD display, diverse measurement functions, fast one-handed operation and outstanding value for money open up a wide range of possible uses.

MEASURING FUNCTIONS:

- TRMS AC, DC voltage measurement;
- TRMS AC, DC current measurement;
- Capacitance measurement;
- Resistance measurement;
- Diod test;
- Mains supply frequency measurement;
- Frequency of digital signals measurement;
- Continuity test (acoustic signalling).

KEY FEATURES:

- **TRMS:** accurate readings on sinusoidal and non-sinusoidal signals.
- **Lead alert:** incorrect lead connection alert.
- **Auto-ranging:** user can switch between auto and manual ranging.
- **Relative zero mode:** relative function for comparing the difference between signals or removing background noise.
- **MAX/MIN/AVG:** recording of maximum, minimum and average values.
- **Data Hold:** data hold feature freezes the display for later view.
- **PC Link:** test results can be downloaded to the computer via the optional PC software.
- **Frequency measurement:** up to 1 MHz.
- **Safety:** CAT IV / 1000 V overvoltage protection.
- **Easy to read:** large bright 4 digits 9999 counts dual LCD display.

APPLICATION:

- High level industrial testing;
- High level electronic fault finding;
- Field servicing;
- Heavy duty electrical testing.

STANDARD SET:

- Multimeter MD 9040 with rubber holster
- Test lead with probe, 2 pcs
- 9 V battery
- Instruction manual
- Warranty



TECHNICAL SPECIFICATION:

Function	Range	Accuracy
TRMS AC voltage (40 Hz ... 20 kHz)	60.00 mV ... 999.9 V	from ±(0.5 % of reading + 3 digits) to ±(3.0 % of reading + 4 digits)
DC voltage	60.00 mV ... 999.9 V	from ±(0.06 % of reading + 2 digits) to ±(0.12 % of reading + 2 digits)
DC current	600.0 µA ... 10.00 A	±(0.2 % of reading + 4 digits)
TRMS AC current (40 Hz ... 1 kHz)	600.0 µA ... 10.00 A	from ±(0.6 % of reading + 3 digits) to ±(1.0 % of reading + 4 digits)
Diode test	2.000 V	±(1.0 % of reading + 1 digit)
Open-circuit voltage	<3.5 V <sub>DC</sub> , Test current 0.4 mA	
Resistance	600.0 Ω ... 60.00 MΩ	from ±(0.1 % of reading + 3 digits) to ±(1.5 % of reading + 5 digits)
Mains frequency	15.00 Hz ... 50.00 kHz	±(0.04 % of reading + 4 digits)
Frequency of digital equipment	5.00 Hz ... 1.000 MHz	±(0.004 % of reading + 4 digits)
Capacitance	60.00 nF ... 25.00 mF	from ±(0.8 % of reading + 3 digits) to ±(6.5 % of reading + 5 digits)
Power supply	9 V battery (NEDA1604G, JIS006P, or IEC6F22)	
Overvoltage category	CAT IV / 1000 V	
Dimensions	208 x 103 x 64.5 mm	
Weight	635 g	



### MD 9035 Automotive Multimeter Designed to Work On Real-World Car Signals

Metrel MD 9035 is a unique automotive multimeter top class with many exciting features, such as: Selectable 4-stroke, 4-DIS/2-stroke, & 2-DIS engine RPM; Selectable Trig (+) / Trig- on % & ms readings; Selectable Sensitivity-Levels on RPM, Dwell, % & ms readings, BeepJack warning, Backlit display and Display hold. MD 9035 is also equipped with automatic range selection and extra fast analog bar-graph.

#### MEASURING FUNCTIONS:

- AC, DC voltage measurement;
- AC, DC current measurement;
- Capacitance measurement;
- Resistance measurement;
- Diode test;
- Both IP (inductive) & IG (contact) RPM;
- ms Fuel-injection on time;
- % Duty cycle;
- Dwell angle;
- Line-Level Hz (ACV, DCV);
- Frequency measurement;
- Continuity test (acoustic signaling);
- Electric field detection;
- Temperature measurement.

#### KEY FEATURES:

- **Line-Level:** measures frequency from 10 Hz to 50 kHz.
- **Auto-ranging:** user can switch between auto and manual ranging.
- **Hold:** data hold function freezes the display for later view.
- **Pickup clip:** Inductive pickup clip accessory for IP-RPM Function.
- **4 Selectable Trigger-Levels:** For IP-RPM, IG-RPM, Dwell, %-Duty and ms Functions.
- **Selectable Trigger:** Positive (+) or Negative (-) Trigger for %-Duty and ms Functions.
- **Selectable Cylinders:** 1, 2, 3, 4, 5, 6, 8, 10 or 12 Cylinders for Dwell and IG-RPM functions.
- **Safe:** CAT II / 1000 V, overvoltage protection.

#### APPLICATION:

- Automotive industry;
- High level industrial testing;
- High level electronic fault finding;
- Field servicing.

#### STANDARD SET:

- Multimeter MD 9035 with rubber holster
- Test lead with probe, 2 pcs
- Thermocouple probe, type K
- Inductive pickup clip
- 1.5 V battery, type AAA, 2 pcs
- Instruction manual
- Warranty



#### TECHNICAL SPECIFICATION:

Function	Range	Accuracy
DC Voltage	60.00 mV ... 1000 V	From $\pm(0.4\%$ of reading + 3 digits) to $\pm(0.7\%$ of reading + 3 digits)
AC Voltage (50 Hz ... 500 Hz)	60.00 mV ... 1000 V	From $\pm(2.0\%$ of reading + 5 digits) to $\pm(2.2\%$ of reading + 5 digits)
DC Current	600.0 $\mu$ A ... 10.00 A	From $\pm(0.7\%$ of reading + 3 digits) to $\pm(0.5\%$ of reading + 3 digits)
AC Current (50 Hz ... 500 Hz)	600.0 $\mu$ A ... 10.00 A	From $\pm(2.2\%$ of reading + 5 digits) to $\pm(1.2\%$ of reading + 5 digits)
Diode Test	1.000 V Open-circuit voltage < 1.6 V	$\pm(1.0\%$ of reading + 3 digits) DC, Test current 0.50 mA
Resistance	600.0 $\Omega$ ... 60.00 M $\Omega$	From $\pm(0.5\%$ of reading + 6 digits) to $\pm(1.5\%$ of reading + 5 digits)
Capacitance	6.000 $\mu$ F ... 2000 $\mu$ F	From $\pm(2.0\%$ of reading + 5 digits) to $\pm(4.0\%$ of reading + 5 digits)
Temperature	-50 $^{\circ}$ C ... 1000 $^{\circ}$ C -58 $^{\circ}$ F ... 1832 $^{\circ}$ F	$\pm(0.5\%$ of reading + 3 digits) $\pm(0.5\%$ of reading + 6 digits)
IP-RPM	RPM 4 (240 ... 20000 RPM) RPM 2 (120 ... 10000 RPM) RPM 2M (60 ... 5000 RPM)	$\pm(2\text{RPM})$
IG-RPM	RPM 4 (60 ... 20000 RPM) RPM 2 (30 ... 10000 RPM) RPM 2M (15 ... 5000 RPM)	$\pm(2\text{RPM})$
Dwell	0.0 ... 360.0 $^{\circ}$ 0.0 % ... 100.0 %	$\pm(1.2\%$ /krpm + 1 digit) $\pm(0.04\%$ /krpm /cyl + 2 digits)
Fuel injection-ms detector	PFI / Multi Point Injection	
	0.05 ms ... 250.0 ms	$\pm(0.05\text{ ms} + 1\text{ digit})$
	0.0 % ... 100.0 %	$\pm(0.04\%$ /krpm + 2 digits)
	TBI / Single Point Injection	
Function	0.05 ms ... 250.0 ms	$\pm(0.05\text{ ms} + 1\text{ digit})$
	0.0 % ... 100.0 %	$\pm(0.04\%$ /krpm /cyl + 2 digits)
	Range	
	Sensitivity (Sin RMS)	
Hz (Line-level) @ ACV & DCV	6 V 60 V 600 V 1000 V	10 Hz ... 10 kHz 0.5 V 5 V 50 V 500 V
Power supply	2 x 1.5 V batteries, type AAA	
Overvoltage category	CAT II / 1000 V	
Dimensions	161 x 80 x 50 mm	
Weight	340 g	

### MD 9030 TRMS General Purpose Digital Multimeter

The MD 9030 TRMS digital multimeter has been designed for use both in the laboratories and in the harsh industrial maintenance and repair sector. TRMS functionality makes the multimeter suitable for a multitude of situations, while the large bright screen with backlight and incorrect lead connection alert make it ideal for working in dark areas.

#### MEASURING FUNCTIONS:

- TRMS AC, DC voltage measurement;
- TRMS AC, DC current measurement;
- Capacitance measurement;
- Resistance measurement;
- Diode test;
- Frequency measurement;
- Continuity test (acoustic signalling);
- Temperature measurement.

#### KEY FEATURES:

- **TRMS:** accurate readings on sinusoidal and non-sinusoidal signals.
- **Temperature measurement:** measures temperature in Celsius up to 300  $^{\circ}$ C and in Fahrenheit up to 572  $^{\circ}$ F.
- **Frequency measurement:** up to 1 MHz.
- **Lead alert:** incorrect lead connection alert.
- **Auto-ranging:** user can switch between auto and manual ranging.
- **Relative zero mode:** relative function for comparing the difference between signals or removing background noise.
- **Data Hold:** data hold feature freezes the display for later view.
- **MAX Hold:** MAX hold feature freezes the maximum measured value.
- **Safe:** CAT IV / 300 V, CAT III / 600 V and CAT II / 1000 V overvoltage protection.
- **Backlight:** large bright 3-3/4 digits, 4000 counts LCD display with backlight for working in dark conditions.

#### APPLICATION:

- Mid level electrical testing;
- Mid level electronic fault finding;
- Field servicing;
- General purpose.

#### STANDARD SET:

- Multimeter MD 9030 with rubber holster
- Test lead with probe, 2 pcs
- 1.5 V battery, type AAA, 2 pcs
- Instruction manual
- Warranty



#### TECHNICAL SPECIFICATION:

Function	Range	Accuracy
DC voltage	400.0 mV ... 1000 V	from $\pm(0.3\%$ of reading + 4 digits) to $\pm(1.0\%$ of reading + 4 digits)
TRMS AC voltage (50 ... 500 Hz)	400.0 mV ... 1000 V	from $\pm(1.5\%$ of reading + 5 digits) to $\pm(4.0\%$ of reading + 5 digits)
DC current	400.0 $\mu$ A ... 10.00 A	from $\pm(1.2\%$ of reading + 3 digits) to $\pm(2.0\%$ of reading + 5 digits)
TRMS AC current	400.0 $\mu$ A ... 10.00 A	from $\pm(1.5\%$ of reading + 4 digits) to $\pm(2.0\%$ of reading + 6 digits)
Diode test	Open-circuit voltage < 1.6 V <sub>DC</sub> , Test current 0.25 mA	
Resistance	400.0 $\Omega$ ... 40.00 M $\Omega$	from $\pm(0.6\%$ of reading + 4 digits) to $\pm(2.0\%$ of reading + 4 digits)
Temperature	-20 $^{\circ}$ C ... 300 $^{\circ}$ C	$\pm(2.0\%$ of reading + 3 $^{\circ}$ C)
Frequency	50.00 Hz ... 1.000 MHz	$\pm(0.5\%$ of reading + 4 digits)
Capacitance	500.0 nF ... 3000 $\mu$ F	$\pm(3.5\%$ of reading + 6 digits)
Power supply	2 x 1.5 V batteries, type AAA	
Overvoltage category	CAT IV / 300 V; CAT III / 600 V; CAT II / 1000 V	
Dimensions	198 x 97 x 55 mm	
Weight	396 g	



### MD 9020 General Purpose Digital Multimeter

The MD 9020 is a high-quality digital multimeter, designed for everyday use in the laboratory and for maintenance and repair work in the field and in the industrial sector as well.

#### MEASURING FUNCTIONS:

- AC, DC voltage measurement;
- AC, DC current measurement;
- Capacitance measurement;
- Resistance measurement;
- Diod test;
- Frequency measurement;
- Continuity test (acoustic signalling);
- Temperature measurement.

#### KEY FEATURES:

- **Temperature measurement:** measures temperature in Celsius up to 300 °C and in Fahrenheit up to 572 °F.
- **Frequency measurement:** up to 1 MHz.
- **Lead alert:** incorrect lead connection alert.
- **Auto-ranging:** user can switch between auto and manual ranging.
- **Relative zero mode:** relative function for comparing the difference between signals or removing background noise.
- **Data Hold:** data hold feature freezes the display for later view.
- **MAX Hold:** MAX hold feature freezes the maximum measured value.
- **Safe:** CAT IV / 300 V, CAT III / 600 V and CAT II / 1000 V overvoltage protection.

#### APPLICATION:

- Mid level electrical testing;
- Mid level electronic fault finding;
- Field servicing;
- General purpose.

#### STANDARD SET:

- Multimeter MD 9020 with rubber holster
- Test lead with probe, 2 pcs
- 1.5 V battery, type AAA, 2 pcs
- Instruction manual
- Warranty



#### TECHNICAL SPECIFICATION:

Function	Range	Accuracy
DC voltage	400.0 mV ... 1000 V	from $\pm(0.3\%$ of reading + 4 digits) to $\pm(1.0\%$ of reading + 4 digits)
AC voltage (50 ... 500 Hz)	400.0 mV ... 1000 V	from $\pm(1.5\%$ of reading + 5 digits) to $\pm(4.0\%$ of reading + 5 digits)
DC current	400.0 $\mu$ A ... 10.00 A	from $\pm(1.2\%$ of reading + 3 digits) to $\pm(2.0\%$ of reading + 5 digits)
AC current	400.0 $\mu$ A ... 10.00 A	from $\pm(1.5\%$ of reading + 4 digits) to $\pm(2.0\%$ of reading + 6 digits)
Diode test	Open-circuit voltage <1.6 V <sub>oc</sub> , Test current 0.25 mA	
Resistance	400.0 $\Omega$ ... 40.00 M $\Omega$	from $\pm(0.6\%$ of reading + 4 digits) to $\pm(2.0\%$ of reading + 4 digits)
Temperature	-20 °C ... 300 °C	$\pm(2.0\%$ of reading + 3 °C)
Frequency	50.00 Hz ... 1.000 MHz	$\pm(0.5\%$ of reading + 4 digits)
Capacitance	500.0 nF ... 3000 $\mu$ F	$\pm(3.5\%$ of reading + 6 digits)
Power supply	2 x 1.5 V batteries, type AAA	
Overvoltage category	CAT IV / 300 V; CAT III / 600 V; CAT II / 1000 V	
Dimensions	198 x 97 x 55 mm	
Weight	396 g	

### MD 9016 Electrical Field Service Multimeter

The digital multimeter MD 9016 is a perfect combination of size, Innovative functions and built-in PC communication. It is capable to detect and diagnose most electrical and electrotechnical problems. Display with large easy-to-read figures and one-handed operation make MD 9016 an extremely easy-to-use. This compact instrument combines a high level of functionality and small size and portability.

#### MEASURING FUNCTIONS:

- AC, DC voltage measurement;
- AC, DC current measurement;
- Capacitance measurement;
- Resistance measurement;
- Diode test;
- Frequency measurement;
- Continuity test (acoustic signaling);
- Electric field detection;
- Temperature measurement.

#### KEY FEATURES:

- **Auto-ranging:** user can switch between auto and manual ranging.
- **EF detection:** non-contact and probe contact electric field detection.
- **Relative zero mode:** relative function for comparing the difference between signals or removing background noise.
- **Hold:** data hold function freezes the display for later view.
- **PC Link:** test results can be downloaded to the computer via the optional PC software.
- **Safe:** CAT II / 1000 V, CAT III / 600 V and CAT IV / 300 V overvoltage protection.

#### APPLICATION:

- HVAC (heating, ventilation and air conditioning) troubleshooting;
- Low level electrical testing;
- Low level electronic fault finding;
- Basic field servicing;
- Hobby work.

#### STANDARD SET:

- Multimeter MD 9016 with rubber holster
- Test lead with probe, 2 pcs
- Thermocouple probe, type K
- 1.5 V battery, type AAA, 2 pcs
- Instruction manual
- Warranty



#### TECHNICAL SPECIFICATION:

Function	Range	Accuracy
DC Voltage	60.00 mV ... 1000 V	from $\pm(0.4\%$ of reading + 5 digits) to $\pm(0.2\%$ of reading + 3 digits)
AC Voltage (50 Hz ... 500 Hz)	60.00 mV ... 1000 V	$\pm(1.0\%$ of reading + 5 digits)
DC Current	600.0 $\mu$ A ... 8.00 A	from $\pm(0.5\%$ of reading + 5 digits) to $\pm(1.8\%$ of reading + 6 digits)
AC Current (50 Hz ... 400 Hz)	600.0 $\mu$ A ... 8.00 A	from $\pm(1.0\%$ of reading + 3 digits) to $\pm(1.8\%$ of reading + 6 digits)
Diode Test	1.000 V	$\pm(1.0\%$ of reading + 3 digits)
	Open-circuit voltage < 1.8 V DC, Test current 0.56 mA	
Resistance	600.0 $\Omega$ ... 60.00 M $\Omega$	from $\pm(0.5\%$ of reading + 4 digits) to $\pm(1.2\%$ of reading + 4 digits)
Capacitance	60.00 nF ... 3000 $\mu$ F	from $\pm(1.5\%$ of reading + 5 digits) to $\pm(2.0\%$ of reading + 5 digits)
Temperature	-50 °C ... 1000 °C -58 °F ... 1832 °F	$\pm(0.3\%$ of reading + 3 digits) $\pm(0.3\%$ of reading + 6 digits)
Frequency of digital equipment	5.00 Hz ... 1.000 MHz	$\pm(0.003\%$ of reading + 2 digits)
Mains frequency	10 Hz ... 50 kHz	$\pm(0.003\%$ of reading + 3 digits)
Power supply	2 x 1.5 V batteries, type AAA	
Overvoltage category	CAT IV / 300 V; CAT III / 600 V; CAT II / 1000 V	
Dimensions	161 x 80 x 50 mm	
Weight	340 g	

### MD 9015 Electrical Field Service Digital Multimeter

The digital multimeter MD 9015 includes all necessary functions required to detect and diagnose most electrical and electrotechnical problems. Display with large easily-read figures and one-handed operation make MD 9015 an extremely easy to use. This compact instrument combines a high level of functionality and small size and portability.

#### MEASURING FUNCTIONS:

- AC, DC voltage measurement;
- AC, DC current measurement;
- Capacitance measurement;
- Resistance measurement;
- Diod test;
- Frequency measurement;
- Continuity test;
- Electric field detection;
- Temperature measurement.

#### KEY FEATURES:

- **Temperature:** measures temperature in Celsius up to 300 °C and in Fahrenheit up to 572 °F.
- **Auto-ranging:** user can switch between auto and manual ranging.
- **EF detection:** non-contact and probe-contact electric field detection.
- **Relative zero mode:** relative function for comparing the difference between signals or removing background noise.
- **Hold:** data hold function freezes the display for later view.
- **PC Link:** test results can be downloaded to the computer via the optional PC software.
- **Safe:** CAT II / 1000 V, CAT III / 600 V and CAT IV / 300 V overvoltage protection.

#### APPLICATION:

- HVAC (heating, ventilation and air conditioning) troubleshooting;
- Low level electrical testing;
- Low level electronic fault finding;
- Basic field servicing;
- Hobby work.

#### STANDARD SET:

- Multimeter MD 9015 with rubber holster
- Test lead with probe, 2 pcs
- 1.5 V battery, type AAA, 2 pcs
- Instruction manual
- Warranty



#### TECHNICAL SPECIFICATION:

Function	Range	Accuracy
DC voltage	250.0 mV ... 1000 V	from ±(0.3 % of reading + 4 digits) to ±(1.0 % of reading + 4 digits)
AC voltage (50 ... 500 Hz)	250.0 mV ... 750 V	from ±(1.0 % of reading + 3 digits) to ±(2.2 % of reading + 6 digits)
DC current	250.0 µA ... 10.00 A	from ±(0.8 % of reading + 3 digits) to ±(2.0 % of reading + 6 digits)
AC current	250.0 µA ... 10.00 A	from ±(1.0 % of reading + 4 digits) to ±(2.5 % of reading + 5 digits)
Diode test	Open-circuit voltage <1.8 V <sub>oc</sub> , Test current 1 mA	
Resistance	250.0 Ω ... 25.00 MΩ	from ±(0.4 % of reading + 2 digits) to ±(1.0 % of reading + 4 digits)
Temperature	-20 °C ... 300 °C	3 °C + 3 digits
Frequency	30 Hz ... 200 kHz	±(0.05 % of reading + 4 digits)
Capacitance	2.500 nF ... 25.00 µF	from ±(1.0 % of reading + 4 digits) to ±(6.0 % of reading + 45 digits)
Power supply	2 x 1.5 V batteries, type AAA	
Overvoltage category	CAT IV / 300 V; CAT III / 600 V; CAT II / 1000 V	
Dimensions	160 x 82 x 48 mm	
Weight	345 g	

### MD 9010 General Purpose Autocheck Digital Multimeter

The MD 9010 is one of the smallest and lightest of our digital multimeters. The MD 9010 unit can be used for a wide variety of applications. The high accuracy, LCD display and features including non-contact voltage detection and an autocheck function make the multimeter extremely versatile and great value for money.

#### MEASURING FUNCTIONS:

- AC, DC voltage measurement;
- AC, DC current measurement;
- Capacitance measurement;
- Resistance measurement;
- Diod test;
- Frequency measurement;
- Continuity test;
- Electric field detection.

#### KEY FEATURES:

- **Autocheck function:** automatic detection of AC voltage, DC voltage or resistance.
- **Auto-ranging:** no need of manual ranging.
- **Pocket-sized:** small, thin, ergonomic design.
- **Lightweight:** 78 g only.
- **Acoustic signalling** on continuity test.
- **EF detection:** non-contact and probe-contact electric field detection.
- **Safe:** protected against wrong connection and overvoltage (CAT III / 300 V and CAT II / 600 V).
- **Easy to read:** LCD display, 3-5/6 digits, 6000 counts.

#### APPLICATION:

- Low level electrical testing;
- Low level electronic fault finding;
- Basic field servicing;
- Hobby work.

#### STANDARD SET:

- Multimeter MD 9010 with rubber holster
- Test lead with probe, 2 pcs
- Battery
- Instruction manual
- Warranty



#### TECHNICAL SPECIFICATION:

Function	Range	Accuracy
DC voltage	6.000 V ... 600.0 V	from ±(0.5 % of reading + 3 digits) to ±(2.0 % of reading + 5 digits)
AC voltage (50 ... 60 Hz)	6.000 V ... 600.0 V	±(1.5 % of reading + 5 digits)
DC current	400.0 µA 2000 µA	±(1.5 % of reading + 3 digits) ±(1.2 % of reading + 3 digits)
AC current	400.0 µA 2000 µA	±(2.0 % of reading + 3 digits) ±(1.5 % of reading + 3 digits)
Diode test	Open-circuit voltage <1.6 V <sub>oc</sub>	
Resistance	600.0 Ω ... 6.000 MΩ	from ±(1.0 % of reading + 4 digits) to ±(2.0 % of reading + 6 digits)
Frequency	10.00 Hz ... 30.00 kHz	±(0.5 % of reading + 4 digits)
Capacitance	100.0 nF ... 2000 µF	±(3.5 % of reading + 6 digits)
Power supply	3 V button battery (IEC-CR2032)	
Overvoltage category	CAT III / 300 V; CAT II / 600 V	
Dimensions	113 x 53 x 10.2 mm	
Weight	78 g	